

REMARKS

The Examiner has rejected claims 46, 72, 73, and 76 as being indefinite. Applicants note that claims 46, 73, and 76 were canceled in the response filed June 21, 2002. Claim 72 has been amended to address the Examiner's concerns. Applicants note that the amendment to claim 72 was previously submitted in the response filed September 27, 2001, but inadvertently omitted in the response filed June 21, 2002.

The Examiner has rejected claims 45-47, 49-51, 54-61, 66, 68, and 77-84 as obvious over Meylaers in view of Lind. Claim 45 is in independent form. The Examiner's rejection states:

Meylaers shows all of the recited elements except for the recited joint. Instead, an additional joint at 13 in the piston is required. Lind shows the recited joint wherein all the degrees of freedom are provided by a single joint at 12. It would have been obvious to one of ordinary skill in the art to use the joint of Lind in Meylaers for its simplicity of construction.

Claim 45 is patentable over Meylaers in view of Lind.

Claim 45 relates to a piston assembly including a double ended member having first and second elements configured for linear motion along a common axis. At least one of the first and second elements is a piston. The piston assembly includes a transition arm coupled to a stationary support. The transition arm includes a drive arm coupled to the double ended member by a joint positioned between the first and second elements. The joint includes an outer member configured for movement relative to the first and second elements and an inner member mounted within the outer member for movement relative to the outer member. The outer member defines an opening for receiving the drive arm, and the inner member defines an opening for receiving the drive arm. The piston assembly includes a universal joint connecting the transition arm to the stationary support by two pins to permit pivoting motion about two axes.

There is no suggestion or motivation for the Examiner's proposed combination.

Meylaers fails to describe or suggest the claimed double ended member having first and second elements configured for motion along a common axis. Rather, Meylaers's pistons are not double ended but have left and right sides that are displaced, with alternately situated ball and socket joints 12 (see, e.g., page 5, lines 8-12). Furthermore, Meylaers's piston rods 4 do not undergo linear motion.

Lind describes an arm 9 of a driving disc 7 received by a joint assembly including a spherical or cylindrical pin 10, which is surrounded by sliding members 11 that engage surfaces 12 of a piston 3. Even if one were to replace Meylaers's ball and socket joint with Lind's joint assembly, the combination would not result in the claimed double ended members since Meylaers does not describe or suggest double ended members.

Furthermore, Meylaers describes piston chambers 27 that receive air from an intake 35 leading to an intake chamber 28. Air from intake chamber 28 enters piston chambers 27 through intake openings 18 and intake valves 19 (Figs. 3 and 4). If one were to replace Meylaers's ball and socket joint assembly with Lind's joint assembly, the joint assembly would block Meylaers's air and fuel intake 35, thus destroying the air intake feature of Meylaers.

In addition, the Examiner is attempting to find motivation for using the joint of Lind in Meylaers "for its simplicity of construction." Applicant submits that the joint of Lind is not simpler than Meylaers' ball and socket joint 12.

Therefore, applicant submits that claim 45, and the claims dependent therefrom, are patentable over Meylaers in view of Lind, for at least the reasons discussed above.

The Examiner has rejected claims 72-76 and 85-93 as obvious over Meylaers in view of Almen. Claims 72, 75, and 89 are in independent form. The Examiner states that:

Meylaers shows all of the recited elements except for the recited joint. Instead, an additional joint at 13 in the piston is required. Almen shows the recited joint wherein all of the degrees of freedom are provided by a single joint at 15. It would have been obvious to one of ordinary skill in the art to use the joint of [Almen] in Meylaers for its simplicity in construction.

Claims 72, 75, and 89 are patentable over Meylaers in view of Almen.

Claim 72, as amended, relates to a piston assembly including a plurality of double ended members. Each double ended member has first and second elements configured for linear motion along a common axis. At least one of the first and second elements is a piston. The piston assembly also includes a transition arm coupled to a stationary support. The transition arm includes a plurality of drive arms, and each drive arm defines a drive arm axis. The piston assembly includes a plurality of joints, and each joint couples one of the plurality of drive arms to a respective one of the double ended members. Each joint provides rotation about the drive arm axis and sliding in the direction of at least one of first and second orthogonal axes

perpendicular to the common axis. A universal joint connects the transition arm to the stationary support by two pins to permit pivoting motion about two axes.

Claim 75 relates to a piston assembly including at least two double ended members. Each double ended member has first and second elements configured for linear motion along a common axis. At least one of the first and second elements is a piston. The piston assembly includes a transition arm coupled to a stationary support. The transition arm is coupled to each of the double ended members by a joint. The joint is positioned between the first and second elements. The joint is configured to move relative to the first and second elements along first and second orthogonal axes perpendicular to the common axis. The joint defines two opposed flat surfaces for the transfer of load between the first and second elements and the transition arm. A universal joint connects the transition arm to the stationary support by two pins to permit pivoting motion about two axes.

Claim 89 relates to a piston assembly including a plurality of double ended members. Each double ended member has first and second elements configured for linear motion along a common axis. At least one of the first and second elements is a piston. A transition arm coupled to each of the double ended members includes a plurality of drive arms. Each drive arm defines a drive arm axis. The piston assembly includes a plurality of joints, and each joint couples one of the plurality of drive arms to a respective one of the double ended members. Each joint provides degrees of freedom in four directions between the transition arm and the respective double ended members. The four degrees of freedom are a) about the drive arm axis, b) about a first joint axis perpendicular to the drive arm axis, c) in the direction of the first joint axis, and d) in the direction of a second joint axis perpendicular to the first joint axis. A universal joint connects the transition arm to a support by two pins to permit pivoting motion about two axes.

There is no suggestion or motivation for the Examiner's proposed combination.

As discussed above with reference to claim 45, Meylaers does not describe or suggest the claimed double ended members having first and second elements configured for motion along a common axis.

Almen describes a block 14 having a spherical recess that serves as a socket bearing for the extremity 15 of the arm 16 of a rocker-head 17. The block 14 is positioned between piston walls 10. Studs 22 in block 14 extend into circular apertures 23 in the adjacent piston walls 10.

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Even if one were to replace Meylaer's ball and socket joint with Almen's joint assembly, the combination would not result in the claimed double ended members since Meylaers does not describe or suggest double ended members.

Furthermore, if one were to replace Meylaer's ball and socket joint assembly with Almen's joint assembly, Almen's joint assembly would block Meylaer's air and fuel intake 35, thus destroying the air intake feature of Meylaers.

In addition, the Examiner is attempting to find motivation for using the joint of Almen in Meylaers "for its simplicity in construction." Applicant submits that the joint of Almen is not simpler than Meylaers' ball and socket joint 12.

Therefore, applicant submits that claims 72, 75, and 89, and claims dependent therefrom, are patentable over Meylaers in view of Almen, for at least the reasons discussed above.

Applicant asks that all claims be allowed. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

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Version with markings to show changes made

In the claims:

Claims 51, 53, and 72 have been amended as follows:

51. (Amended) The piston assembly of claim 45 wherein the joint is configured such that the drive arm received in the joint is rotatable about an axis of the drive arm.

53. (Amended) The piston assembly of claim 52 wherein the joint is configured such that the drive arm received in the joint is rotatable about an axis of the drive arm.

72. (Amended) A piston assembly, comprising:
a plurality of double ended members, each double ended member having first and second elements configured for linear motion along a common axis, at least one of the first and second elements being a piston,
a transition arm coupled to a stationary support, the transition arm including a plurality of drive arms, each drive arm defining a drive arm axis, and
a plurality of joints, each joint for coupling one of the plurality of drive arms to a respective one of the double ended members, each joint providing rotation about the drive arm axis, and sliding in the direction of at least one of first and second orthogonal axes perpendicular to the common axis [drive arm axis], and
a universal joint connecting the transition arm to the stationary support by two pins to permit pivoting motion about two axes.